DETERMINATION OF THE INTERNAL RESISTANCE OF A CELL

Specification reference: **AS Unit 2.3 – D.C. circuits**

Theory:

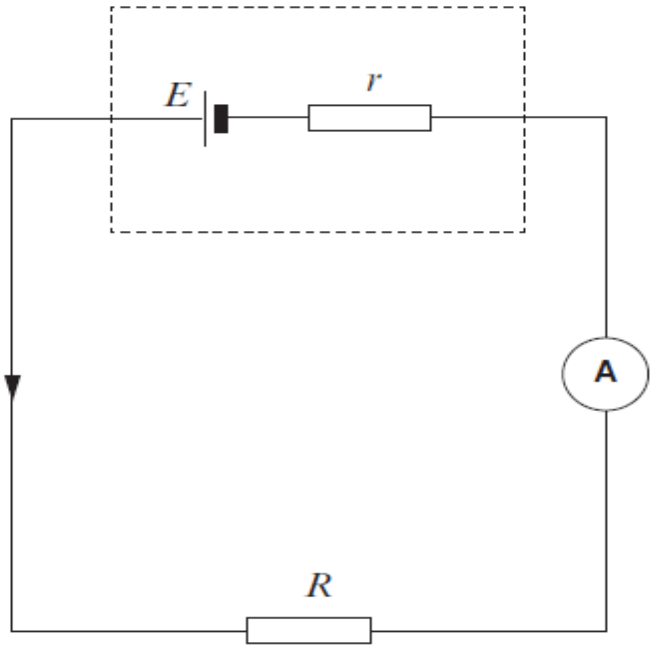
The equation used for determining the internal resistance is $V = E - Ir$ where V is the terminal p.d. of a cell; E is the emf of the cell; I the current flowing in the circuit and r is the internal resistance. $V = IR$ and the equation can be re-written as $R = \frac{E}{I} - r$. Therefore a graph of R against $\frac{1}{I}$ should be linear.

Apparatus:

Cells – e.g. 3 or 4 × 1.5 V "D" type batteries connected in series
Switch
Ammeter or multimeter set to A range - ±0.01 A
Various resistor values 0 - 60 Ω

Experimental method:

The circuit should be set-up as follows:



The resistor values should be varied and the current values recorded. Plot a graph of R (y-axis) against $\frac{1}{I}$ (x-axis). The graph should be a straight line with the intercept on the y-axis which is equal to the value of the internal resistance.

Extension:

The current can also be varied and the terminal potential difference measured. A graph of potential difference against current should be linear and the emf of the cell could be determined.

Practical Techniques:

- Use appropriate analogue apparatus to record a range of measurements (to include length/distance, temperature, pressure, force, angles, volume) and to interpolate between scale markings.
- Use calipers and micrometers for small distances, using digital or vernier scales.
- Correctly construct circuits from circuit diagrams using D.C. power supplies, cells, and a range of circuit components, including those where polarity is important.
- Use ICT such as computer modelling, or data logger with a variety of sensors to collect data, or use of software to process data.

Relevant previous practical past papers:

- PH3 2007 Q2
- PH3 2011 Task B4